UW Dairy Pipeline

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Quality control for high-end whey

by W. James Harper, Ph.D.

In a typical cheese plant, revenue from whey sales is often the difference between profit and just breaking even. Long considered a by-product or even a waste product, whey must now be considered a valuable raw material that deserves the same "tender loving care" as any other dairy food product. Dairy manufacturers willing and able to produce high-quality whey suitable for the production of value-added specialty products such as high-protein whey protein concentrates (WPC) and whey protein isolates (WPI) can cash in on a considerably more lucrative market than those who persist in producing whey as a commodity only.

The price difference between protein in the form of common 34-percent WPC ($1.50 per pound of protein) and protein in the form of 75-percent WPC can be $2.00 per pound of protein. The protein in 95-percent WPI is worth about $5.50 more per pound than protein in 34-percent WPC.

The cash value of purified whey proteins is based on their roles as functional ingredients in formulated foods. To be useful as a value-added, functional food ingredient, a protein must possess appropriate properties, and these properties must be constant from one batch of protein to the next. The functional properties required depend on the specific food application, but may involve factors such as solubility, gel formation, emulsification, foam formation, or water binding (Table 1).

What's Inside:

The functional properties of whey-based food ingredients, and therefore the value of the whey used to produce them, are directly related to how the milk or whey is handled before, during, and after cheesemaking. Good quality control in whey production means using consistent methods every day to minimize variations in whey composition. Changes in cheesemaking or in whey or milk handling will alter whey composition to some extent, and very small changes in whey composition can have large effects on the composition of high-protein, value-added whey products. For example, 75-percent WPC is at least 30 times more concentrated than the original whey, so the relative abundance of minor whey components retained in the WPC, and thus their impacts on functionality, may be amplified by a similarly large factor. Failure to institute quality assurance standards and consistent methods for all manufacturing steps is likely to result in a whey-derived ingredient that is fairly consistent in gross composition but highly variable with respect to its suitability as a food ingredient.

Milk Quality

With any food ingredient, the quality of the finished product is directly related to the quality of the raw material. The quality of whey begins with the quality of the milk. Generally, milk suitable for cheese production is also suitable for the manufacture of whey-based food ingredients. Quality standards for fluid milk are equally applicable for raw whey.

Controlling the microbial load in cheesemilk is just as important for producing quality whey as it is for producing quality cheese. Psychrotrophic bacteria, which are common in raw milk supplies, produce remarkably heat-resistant proteolytic and lipolytic enzymes that can survive pasteurization and adversely affect functionality and flavor in whey protein products. Moreover, the changes caused

continued next page...

Table 1. Protein functionality in food.

Functional Property	Food system
Solubility	Beverages
Water absorption and binding	Meats, cakes, breads
Viscosity	Soups, gravies, salad dressing
Gelation	Meats, curds, baked goods, cheese
Cohesion-adhesion	Meats, baked goods, pasta
Elasticity	Meats, bakery
Emulsification	Sausages, dressings, coffee whitener, soup, cakes, infant formula
Fat absorption	Sausages, doughnuts
Foaming	Chiffon desserts, cakes, whipped toppings.

Adapted from Kinsella in: *Food Proteins*, ed. P.F. Fox, 1982.

by these enzymes are far more evident in the functional properties of whey protein products than in cheese. Variations in the levels of psychrotrophic bacterial enzymes in cheesemilk or whey are a common cause of variability in whey protein functionality.

The somatic cell count of cheesemilk is another important factor impacting the quality of whey protein products. High somatic cell counts are associated with reduced cheese yield due to an increased level of plasmin, a proteolytic milk enzyme that acts on casein. Peptides produced by this protease end up in the whey and change the functional properties of the concentrated whey proteins.

When standardizing milk for cheesemaking by removing cream, the temperature of separation can be important. Milk separation temperature affects the fat globule membrane content of whey, altering the functionality of the whey proteins. Hot separation (140°F) improves the functional properties of WPC as compared to warm separation (90°F).

Changes in milk pasteurization time and temperature will have an impact on whey protein functionality. It is best to keep the time and temperature of heat treatments constant from day to day, and to avoid over-pasteurizing. A variation of as little as 2°F in pasteurization temperature can substantially change the functional properties of whey-derived products.

Whey composition

The manufacture of different cheese varieties results in wheys of different composition, and wheys made from the manufacture of the same cheese variety will vary from one plant to another. Within a given plant, variations in whey composition are influenced by numerous factors related to the cheesemaking procedure. Of particular importance are drain pH, which affects the mineral content of the whey, and the choice of coagulant used.

Non-chymosin microbial coagulants usually have a greater resistance to heat than does chymosin (rennet). The increased heat resistance of some microbial coagulants means that these proteolytic enzymes are not inactivated by whey pasteurization. The enzymes persist in whey and cause functional or flavor defects in some food systems. Use of chymosin or a microbial coagulant modified for reduced heat stability will minimize enzyme carry-through to the whey.

Cheese whey contains up to about 0.05% fat. Whey proteins function best as food ingredients when as much fat as possible is removed from the whey. Because WPC concentrated by ultrafiltration retains lipids in the retentate, thorough separation to minimize the fat content is an important first step in whey processing.

Whey handling

The handling of whey prior to further processing is of paramount importance to minimize changes in whey quality. Proper handling is based on controlling microbial growth while minimizing damage to

whey proteins caused by enzymatic activity or heat denaturation. This can be achieved in a variety of ways:

- Pasteurize whey immediately after production.
- Minimize holding time between whey production and processing.
- When holding whey, cool and hold at or below 39°F, or heat and hold at temperatures above 122°F.
- Maintain the same good cleaning and sanitation practices for whey handling as for handling fluid milk or cheesemilk.

Whey is an excellent growth medium, and at the time of production the organisms in whey are generally growing. The role of psychrotrophic bacterial enzymes has already been cited with regard to milk quality. Psychrotrophic bacteria should not exceed 100,000/ml at any time from the production of the milk until the final product is packaged. Growth of starter organisms and adventitious microflora must also be controlled so that whey pH remains constant from production through processing.

Pasteurization of whey is a useful step in minimizing microbial growth and the resultant changes in the properties of the whey product being produced. The practice of holding whey overnight before pasteurizing should be avoided whenever possible. Most spoilage bacteria grow well at room temperature, so holding whey for even a few hours under non-refrigeration conditions gives any residual bacteria an opportunity to grow and reach large numbers before the whey is processed.

If whey must be held for long periods between production and processing, or if it is shipped to another site for processing, temperature control is necessary. This is true for both raw and pasteurized whey. There are advantages and disadvantages to both heating and cooling whey for storage or shipment. Degradation due to residual lipase and protease activity and the slow growth of psychrotrophic organisms can become significant after long periods of refrigeration (>12 hrs). On the other hand, holding at or above 122°F for more than five or six hours can cause changes in the whey proteins, as well as create an environment where thermophilic bacteria can take hold.

Conclusion

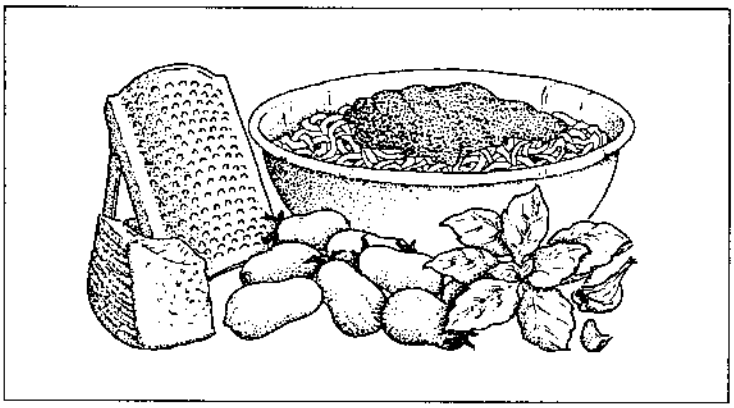
For whey proteins to be accepted as value-added ingredients, dairy manufacturers must overcome the misconception that whey is a waste product — an attitude that has been ingrained for more than 4,000 years. Cheesemakers have an opportunity to improve their profit margins by collecting a premium price for high-quality whey protein. Those who treat whey as an "orphan" by-product can expect to produce whey as only a relatively low-value commodity. ■

This and that...

Dr. W. James Harper returned for his fifth short visit to CDR as a senior visiting scientist May 10. A professor emeritus at the Ohio State University, Harper participated in research planning and provided technical assistance in a number of areas during his one-month stay, including milkfat, whey proteins, and cheese.

Dr. Ki-Young Lee, assistant professor of biochemical engineering at Chonnam National University in Korea, and **Dr. Finn Vogensen** of the Royal Veterinary and Agricultural University in Denmark arrived for year-long shifts as CDR visiting scientists in July. Dr. Vogensen will join Assistant Professor of Food Science **Jim Steele** in examining and characterizing the genetic mechanisms regulating thermolytic responses in certain strains of *Lactococcus lactis* ssp. *cremoris*. Dr. Lee will work with Assistant Professor of Chemical Engineering **Doug Cameron** on a project to produce and characterize a newly-developed polysaccharide gum manufactured from whey permeate.

Former UW Food Science graduate student **Dr. Hugo Garcia** returned to UW in June as a CDR visiting scientist. A professor of Food Science at the Technological Institute of Veracruz in Mexico, Dr. Garcia will participate in a research project with Associate Professor of Food Science **Kirk Parkin**. The scientists are working toward developing a commercial-scale process to produce and recover emulsifiers through lipase-mediated modification of butteroil. His visit is scheduled to last through August. ■



The Curd Clinic

Question: I've been told that brine-salted cheeses can be contaminated with *Listeria monocytogenes* if the bacteria gets into the brine. How can this be? I thought salt killed bacteria.

Answer: It is true that brine appears to have been the source of *Listeria monocytogenes* on at least one occasion involving the recall of mozzarella cheese. In that case, the pathogen was apparently introduced into the brine via a contaminated piece of equipment.

It is also true that salt brines can be quite detrimental to many types of bacteria, particularly when the salt concentration is near saturation (e.g., 23-24%), pH is near 5.0, and the brine temperature is relatively high.

However, *Listeria monocytogenes* is a notably salt-tolerant species that can survive for weeks (but not grow) in even highly-concentrated salt solutions. Although *Listeria* surviving in a typical cheese brine is probably inactive and possibly damaged, it can recover and resume growth on a cheese surface if conditions are right after the cheese is removed from the brine.

In addition, pockets of diluted brine can develop where exuding cheese whey is trapped near the surface of the brine tank. Unless the brine is regularly agitated, the salt concentration in these pockets can drop to a level that will permit the survival and even growth of pathogens in the brine tank itself.

Several studies suggest that various pathogens can be found in highly saline solutions, although the test conditions used in these studies did not exactly duplicate conditions in properly maintained cheese brines.

In one study *Listeria monocytogenes* survived for 24 days in a nutrient broth containing 24% salt and 1% glucose at 68°-75°F. When the salt content was decreased to 10%, the pathogen persisted for more than a year. Had the broth temperature been lower, survival of the pathogen would probably have been longer. Conversely, survival time in this nutrient broth could have been shortened by a reduction in pH, which was approximately 6.8.

Additional laboratory experiments have shown that *Listeria* can grow at a wide range of temperatures in solutions containing up to 12% salt at a pH of 5.0. The pH of cheese brine is normally somewhat higher than 5.0.

Other salt-tolerant food-borne pathogens include salmonellae and *Staphylococcus aureus*. As with *Listeria*, salmonellae can survive in salt brine for long periods. In one study, three species of *Salmonella*, including *Salmonella typhimurium*, survived for up to 34 days in a nutrient broth containing 25% salt at 59°-64°F and at a pH of about 6.8. Survival time may have been shorter had the pH of the broth been reduced to near 5.0.

Staphylococcus aureus is particularly adept at growing in high-salt environments. This pathogen can grow in the presence of 16% salt, although it does not produce enterotoxin when salt concentrations exceed 12%.

The ability demonstrated by these organisms to survive in high-salt environments shows that cheesemakers cannot simply rely on salt to control pathogens in brines. Thus, proper brine maintenance is essential to ensuring that your brine tanks do not become havens for unwanted bacteria. Taking the following steps will reduce the length of time that salt-tolerant bacteria can survive, should they get into a brine:

continued page 9...

UW dairy research projects: Milk component utilization

Numerous dairy foods research projects are underway at UW-Madison. The following are only those involving milk component utilization.

1. Modification of milkfat composition by production of null mutants for acetyl-CoA carboxylase in transgenic mice. Dr. Robert Bremel, Dept. of Dairy Science and Dr. K.H. Kim, Purdue University. (NDPRB) 7/89-6/92

2. Novel affinity methods for recovery of enzymes from agricultural liquids. Dr. Mark Etzel, Dept. of Food Science. (Hatch Grant) 9/93

3. Use of immobilized enzymes in the treatment of milkfat. Dr. Charles Hill, Dept. of Chemical Engineering. (NDPRB) 7/89-6/92

4. Incorporation of butterfat fractions into chocolate and confectionery. Dr. Richard Hartel, Dept. of Food Science. (NDPRB) 7/89-6/92

5. Removal of lipids from raw sweet whey. Dr. Srinivasan Damodaran, Dept. of Food Science. (NDPRB) 7/91-6/93

6. Demand analysis of dairy products using cross sectional data. Dr. Brian Gould, CDR/Dept. of Agricultural Economics. (WMMB)

7. Economic valuation of milk components. Dr. Brian Gould, CDR/Dept. of Agricultural Economics. (WMMB)

8. Conversion of whey components to commercially valuable products. Dr. Doug Cameron, Dept. of Chemical Engineering. (WMMB) 7/88-4/92

9. Effect of protein and non-protein components on thermal gelation of whey protein concentrate. Dr. Srinivasan Damodaran. Dept. of Food Science. (NDPRB) 7/90-6/93

10. Nondestructive techniques for evaluating physical properties and quality of food materials. Dr. Sundaram Gunasekaran, Depts. of Food Science and Agricultural Engineering. (Hatch Grant) 9/93

11. Construction of a D-lactic dehydrogenase negative strain of *Lactobacillus helveticus*. Dr. James Steele, Dept. of Food Science. (WMMB) 7/90-6/93

12. Lipase-catalyzed synthesis of novel emulsifiers from butteroil and lactose for use as food ingredients. Dr. Kirk Parkin, Dept. of Food Science. (NDPRB) 7/91-6/93

13. A new technology for milkfat products. Dr. Richard Hartel, Dept. of Food Science, and R.S. Jebson, Massey University, Dept. of Food Science, New Zealand. (WMMB) 9/90-8/92

Dairy Resource Center

New publications databases

CDR staff can now access the research literature more easily using two new bibliographic databases. The Center's technology transfer staff is available to help university or industry researchers locate CDR publications indexed in these databases. One of the databases contains citations of all journal articles and other outside publications resulting from CDR-administered research projects. These publications are entered in a Pro-Cite database application. The other database uses Paradox software to index all CDR research project reports published in the Center's Annual Reports. Citations can be based on searches for P.I., project topic, keywords, or nearly any other set of criteria contained in the citation. For help with literature searches of CDR research publications, call CDR at (608) 262-2217.

UW dairy researcher directory

Dairy foods technologists interested in contacting University of Wisconsin dairy scientists will appreciate a copy of the UW Dairy Foods Research Directory. The directory contains the phone numbers, addresses, areas of specialization and primary research interests for 46 UW scientists involved in dairy foods research. Published by CDR in Nov. 1991, the directory is cross-indexed by researcher name and research area for easy access. For a free a copy call Lisa Tiedemann at (608) 265-2133.

Sanitizer Properties	**Inorganic Chlorine:** sodium hypochlorite	**Organic Chlorine Compounds** di-, tri-chloroisocyanurate; chloramine T
Germicidal Activity:	High	High
Germicidal Specifity:	Generally effective, even spores, virus; reference sanitizer	Generally effective, similar to sodium hypochlorite
Germicidal Speed:	Fastest	Not as fast as hypochlorite
Form:	Concentrated hypochlorite solution or powder	Powder
Stability	Good as powder, fair as liquid	Good
Toxicity	Yes	Yes
Irritancy	Yes	Yes
Dilution:		
Ease of Preparation	Easy	Easy
Ease of Measurement	Easy, iodometry, test kits available	Easy, iodometry, test kits available
Stability	Good	Good, lasts longer than hypochlorite
Toxicity	Low	Low
Irritancy	Low	Low
Vapors	None at correct pH	None at correct pH
Color	None	None
pH Requirement	Most active at pH of 6-7.5	Best at pH of 6-7.5
Temperature	Cold water, maximum temp. 115°F	Cold water, maximum temp. 115°F
Film Formation:		
Bacteriostatic Film	No	No
Penetration	Poor	Poor
Water Hardness:	Activity decreases in very hard water (>500 ppm)	Activity decreases in very hard water (>500 ppm)
Organic Matter in Water:	Reacts to form chloramines	Reacts to form chloramines
Corrosion:		
Solution	Slight to moderate	Low
Vapor Space	Possible, through vapor condensation	Possible, through vapor condensation
Special Conditions	Very corrosive below pH 6	Very corrosive at low pH
Used For:	All food contact surfaces, CIP	Good sanitizer for all stainless utensils, food contact surfaces
Advantages:	Best sanitizer for clean stainless food contact surfaces; lower price than organic chlorine	Fast, effective; excellent for all stainless steel surfaces
Disadvantages:	Requires tight pH and concentration control; highly corrosive, particularly to stainless steel, when improperly used; produces corrosive gas above 115°F	May be corrosive if not properly used; produces corrosive gas above 115°F

Chart compiled by Drs. Robert L. Bradley and Hans F. Bohner

Properties of Chemical Sanitizers

Iodine Compounds: iodophor, 2-50% iodine stabilized in surfactant and acid	**Acid Anionic:** organic acids (formic, acetic, propionic) and anionic surfactant	**Chlorine Dioxide**	**Quate** QUAT chlorid ammc
Less effective than chlorine	Good	High, better than chlorine	Varied
Good against yeasts, viruses, bacteria, algae, molds	Good, broad spectrum, vegetative cells	Generally effective against all bacteria, viruses, yeast, algae, mold	Good gra
Not as fast as hypochlorite	Good at proper pH	Fast-acting	Moder
Solution of iodine, stabilized in surface active agent and acid	Solution of concentrated acid and surfactant	Precursors, or sodium chlorate and hypochlorite solutions	Conce
Good at room temp., avoid temp. >120°F	Good	Good	Good
Yes, some surface-active agents are toxic	Relatively low	Yes	Yes
Yes	Yes	Yes	Yes, m
Easy	Easy	Complex equipment or procedure	Easy
Easy, iodometry, test kits available	Good, pH is measured	Difficult, titrations, interference	Test ki
Stable at room temp. and below	Excellent, even at high temperature	Moderate, decays to chloride	Excell
Some wetting agents may be toxic	Low	Moderate	None
None, used for hand wash	Low	Very irritating vapors, even at 17ppm	None
Iodine odor, vaporizes above 120°F	None	Typical odor, yellow-green, dangerous	None
Red-brown, used to judge concentration	None	Yellow-green or red-brown	None
Effective at low pH, 4 or lower	pH 1.9-2.5 for best activity	Effective at broad pH, best at 8.5	Effecti
Maximum temp. 120°F	Broad range	Use at low temp. to avoid vaporization	Maxim
Slight, loses activity	Yes	No	Yes
Good, depends on wetting agent	Good, depends on wetting agent	Poor	Very g
Activity decreases in water of high alkalinity (>500 ppm)	Slower, more sanitizer needed in hard water	No effect	Inactiv con
Somewhat more stable than chlorine	Reacts with milkstone, low reactivity with organic matter	Little influence, even at high organic load	Moder inac
Low	Possible, uncommon	Very corrosive at low pH	None
Possible, through vapor condensation	None	Slight corrosion	None
Pitting with low pH, high-chloride water	Corrosion with high-chloride water	Vapor space corrosion with high temp.	None
Aluminum, hand sanitizer, plastics, tile, all food contact surfaces	Combined acid cleaning, rinsing sanitizing; ideal in CIP systems	High organic load situations: poultry, fruit, ultrafiltration, water treatment	Non-f dra
Good for farm uses; effective, eliminates milkstone	Eliminates milkstone; best for hard water and CIP	Not affected by organic matter; effective against all types of organisms	Useful last env per
Discolors; off-flavors at even low concentrations; less effective than chlorine	Less active against spores; may leach Cu from dairy metal; amount of foam varies with wetting agent	Complex preparation; corrosive in acid solution; very difficult to handle unless preparation is automated	Ineffe ppr *fluo* cult fog

ɪrnary Ammonium Compounds: 'S, QAC, benzalkonium ɪde, N-alkyl dimethybenzyl ɔnium chloride (ADBAC)	**Peroxyacetic Acid:** peracetic acid, acetic acid and hydrogen peroxide
', poor	High
ıgainst molds, ineffective with some m-negative bacteria	Good, particularly psychrotrophs and spores
'ate	Fast
ntrated solution	Stabilized solution of about 25% H_2O_2 in acetic acid
	Good
	Yes
oderate	Yes, pungent smell, potent and possibly hazardous oxidizer on skin
	Easy
t	Easy, titration of oxides
ɔnt	Good
	Low
	Irritating to nose
	Pungent
	None
ve over broad pH range	Effective over broad pH range
ıum 120°F	Cool to warm
	Yes
ɔod, penetrates porous surfaces	Good
'ated in hard water, higher centration needed	Limited effect
'ately stable, high concentrations ɔtivate QUATS	Reacts and loses activity
	Safe for 304, 316 stainless and aluminum
	None
	Do not use above 0.4%
ɔod contact, porous materials, walls, ins	All food-contact surfaces
on non-food contact surfaces; ing film; detergent properties; good ironmental sanitizer at 1,000 ppm; sistent	Use on all food-contact surfaces
ɔtive against some organisms at 200 n (no rinse dilution), ie, *S. aureus*, *P. rescens*, and *E. coli;* slows cheese ures at 20 ppm; irritating to user if ged	Odor in confined areas; store concentrate in plastic only because of metal reaction

by Dr. R.L. Bradley, Professor of Food Science, University of Wisconsin-Madison

Dr. Hans F. Bohner and I put this chart together to allow you to compare, on one sheet, the properties of various types of sanitizers currently approved for use in the dairy industry. This information was gleaned from data sheets, personal use situations and research data collected in our laboratory.

Chlorine in the form of sodium hypochlorite has been the reference solution for sanitizing for at least 50 years. All sanitizers have varying properties and efficiencies, and are more or less useful depending on the specific sanitizing application. For example, corrosion is a problem with chlorine-based sanitizers. Once pit corrosion is initiated, it keeps going and growing. What alternatives allow you to avoid pit corrosion when the sanitizer will remain on the stainless steel for longer than 30 minutes? Scanning the chart shows that acid anionic will not corrode. In fact, this is the sanitizer of choice for CIP.

No cost comparisons are given here because the services of a technical representative from the selling company are often included in the sanitizer cost to ensure that the dairy plant gets all of its "bang for the buck."

Curd Clinic, from page 4

1. Keep brine salt content near saturation, or about 24%. Measure salt content periodically with a salometer or chloride analyzer to be sure that the salt level is where you think it is.

2. Agitate the brine regularly to keep pockets of low salt concentration from forming near the surface. Formation of salt crystals on the bottom of the brine tank is no guarantee that the brine is saturated at the surface; the heavier, saturated brine will just sit on the bottom of the tank unless you stir it up. Circulating brine through a filtering system will remove particulate matter that help nourish bacteria, and newer filtration equipment can remove most of the bacteria in the brine.

3. When making new brine, add acetic acid or lactic acid to adjust brine pH down to the pH of the cheese. Not only will this help protect against pathogens, but it is also important in preventing cheese surface defects [for details on brine composition and cheese surface defects see "The Curd Clinic," *UW Dairy Pipeline* December 1991 — ed.].

Finally, pathogens should never have the opportunity to reach your brine tanks. As in so many other situations, proper environmental sanitation practices are essential for keeping these pathogens, as well as numerous other troublesome organisms, out of your plant [see "Beating *Listeria*: Tips from the WDATCP," *UW Dairy Pipeline* Spring 1992 — ed.]. ■

Curd Clinic Doctor for this issue is
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Quality assurance for quality decisions

by Fritz Buss, Laboratory Products Manager, Nelson-Jameson Inc.

What gives a food company manager confidence that a day's production meets the requirements and specifications of its customers? The answer to this question is typically the company's Quality Assurance Program. A good quality assurance program employs management tools such as "Hazard Analysis Critical Control Points" and "Statistical Process Control" to meet high standards in every department of the operation. Most importantly, the product confidence inspired by a thorough and accurate quality assurance program is essential for making the tough decisions that can affect the security of a company's owners, employees and customers.

This is particularly important when supplying or buying ingredients from another plant. When one processor supplies materials to another, the customer will usually inspect the materials through their own quality assurance program. Because this emphasizes product specifications, suppliers are vulnerable to losses due to rejected product. In the incident described below, a dispute over returned product forces two companies to compare their quality assurance programs. Although the specifics of this example are fictional, similar disputes are not uncommon.

Company A buys cheese from company B. Company A routinely tests samples from loads sent by B to check various parameters, including salt content. One day, company A's laboratory results for salt indicated the cheese was out of specification. Resampling and retesting confirmed preliminary results, and the load was returned to company B.

Upon return of the shipment, the quality assurance manager for B contacted his counterpart at A and vehemently argued that, according to his laboratory, the cheese was well within required specifications and that A's action was unjustified. Convinced A was in error, B's quality assurance manager had the cheese sent to a less discriminating customer, and charged company A for the extra shipping.

A rift developed between the companies because of this incident, and the plant managers agreed to

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submit their cases to a third party for arbitration. The quality assurance managers of both companies were asked to defend their decisions regarding the disputed cheese shipment. Both laboratories relied on automated devices for the many samples tested each day. However, vast differences existed between the steps the two laboratories used to assure test accuracy. Here is a summary of the information presented:

Laboratory B used a device for salt testing which had been adapted from an application other than testing food products. Standardization was done once per day using a solution of water and salt. A single grab sample had been tested from each lot in question, and results were within acceptable limits. While batch sheets indicated the appropriate amount of salt had been added, these could not be reconciled with the raw material inventory or salt content of the whey.

Laboratory A, on the other hand, had an extensive quality assurance program for assuring the accuracy of its raw materials testing program. This included the following features:

- The laboratory had selected an automatic analyzer which was identified in an official manual for testing food products, and the test procedure was validated by the laboratory for specific products tested through comparisons with the official reference method. The instrument was checked daily using fresh standard according to the manufacturer's instructions.

- Analysts were trained for the salt testing procedure defined in the laboratory's manual of tests. These tests were adopted from *Standard Methods for the Examination of Dairy Products.*

- Each analyst tested a split of the same blended cheese sample daily. Results indicated the capability of the laboratory to produce repeatable and accurate measurements.

- Each analyst participated in a quarterly interlaboratory collaborative to determine reproducibility with regional laboratories.

- Every tenth sample was a split of cheese tested according to the standard methods procedure. Placement of these results on a control chart indicated ongoing precision and accuracy.

- Screening samples, taken to audit shipper's results, were taken from three randomly selected locations for each lot present on the load. Each sample was assigned a unique number representing the shipment and lot sampled.

- Samples in each set were co-mingled and thoroughly blended. A subsample was then taken for testing. A portion of the composite was also retained in a sealed container and placed in refrigerated storage.

- When results of the screening samples were outside acceptable limits, the retained sample was retested to eliminate the possibility of laboratory error. Then additional samples were taken from the questionable lot, using a recognized statistical sampling plan.

- A log of results for testing and calibration procedures was maintained. Information logged included dates of collection and testing, cheese type and source, test method, name of analyst, and displayed and calculated values. Results of check sample tests were also logged.

- A separate log was also kept of results from analyst and laboratory proficiency tests. This included data which supported the capability of the laboratory and of each analyst to produce accurate and precise results. Corrective measures were taken when weaknesses in methodology were identified.

Based on the cases presented on behalf of their laboratories by each laboratory manager, the decision by company A to reject the load was upheld. Company B absorbed the hauling charges.

Few companies back their decisions to ship (or return) products with laboratory quality assurance programs as thorough as Company A's, and more and more quality assurance occurs outside the laboratory as part of the production process. However, as the story above illustrates, the probability of avoiding problems related to product quality is directly related to the attention given to quality assurance before critical decisions must be made.

Additional training in analytical excellence will be available at the fall conference of the Wisconsin Laboratory Association. For registration materials call (715) 387-1151.

Nutritional labeling: Preparing for change

by Emerita Alcantara, Ph.D., R.D.

Help is on the way for dairy processors and manufacturers preparing for the sweeping labeling changes proposed by the Food and Drug Administration. But there's little time to spare.

FDA must finalize labeling regulations by November 1992. Then, food and dairy processors and manufacturers will have six months to get ready for compliance before the May 1993 implementation deadline mandated under the Nutrition Labeling and Education Act (NLEA) of 1990.

To help processors and manufacturers through the intricacies of the new labeling requirements, some dairy industry organizations are sponsoring labeling programs and workshops, as well as providing technical and regulatory assistance.

The International Dairy Foods Association (IDFA) will offer workshops, labeling manuals, a nutritional labeling database, and technical assistance. The manuals and workshops will cover new labeling requirements for fluid milk products, cheese, butter and ice cream, as well as the regulations and guidelines for use of health claims. The Association's nutrient database is designed to help industry personnel calculate the nutritional content of selected dairy products and to generate the nutritional information required on the label. These resources are expected to be available in early 1993.

The American Dairy Products Institute (ADPI) is also developing a database for nutrition labeling. The ADPI database will cover dry milk and whey products, and evaporated milk and related products.

Meanwhile, food industry representatives argue that six months isn't long enough to prepare for and implement all of the label changes, that it will cost billions of dollars, create environmental problems in disposing of large amounts of currently-used packaging materials, and cause undue economic hardship to the industry. Under the act, FDA may grant an extension of up to one year beyond May 1993 (to May 1994) on the basis of undue economic hardship.

The U.S. Department of Agriculture has granted a one-year extension, to May 1994, for labeling regulations on meat and poultry products. Manufacturers of all other food products are requesting the same concession from FDA.

Consumer advocates, however, are pressuring FDA to adhere to next spring's deadline, saying that even as little as a year's delay could result in thousands of additional cases of cancer and heart disease during the next two decades.

FDA expects to make a decision about any deadline extension this summer.

Also, the agency has been analyzing results of consumer and health group research that compares seven different nutrition label formats, including the current format. Consumers participating in the FDA study preferred a format that spotlights certain nutrients, specifically fat, saturated fat and cholesterol, as well as one that characterizes the level of each nutrient as low, medium or high. Consumers say these formats convey the most information.

FDA will publish a proposal outlining the proposed format in the Federal Register this spring. The public then will have 60 days to comment before the agency makes its final recommendation. FDA is seeking comments on label format factors such as consumer preference, consumer comprehension, the amount of space that may be devoted to labeling on various products, and the role of a nutrition label. For example, should a label simply provide information about a particular food, or should it also teach people about a healthy diet? Whatever FDA's decision, the format proposals will have the same implementation deadline as the general regulations, meaning manufacturers will be required to change their nutrition labels only once.

Continuing consultation between FDA and the groups representing the dairy industry will be key to ensuring that industry input is considered in these decisions, and that industry resource programs conform with FDA rules and guidelines. ■

Emerita Alcantara is director of manufacturer relations for Dairy Council of Wisconsin, Inc. DCW's manufacturer relations program provides nutritional information and technical assistance to dairy processors and manufacturers in Wisconsin, northern Illinois and northwest Indiana. For more information call (708) 655-8866.

Calendar of Events

July 15 ***Wisconsin Dairy Products Association Annual Cheese and Butter Evaluation Clinic.*** Wisconsin Rapids, WI. To register, or for more information call Brad Legreid at (608) 221-1035.

July 20-31 ***Microbiology and use of starter cultures.*** UW-Madison Dept. of Food Science Special Topics Course with Dr. W.E. Sandine. Call Sarah Quinones at (608) 262-2217 for information.

Aug. 17-21 ***Milk Pasteurization and Process Control School.*** Madison, WI. For information call Bob Bradley at (608) 263-2007. To register call the CALS Conference Office at (608) 263-1672.

Aug. 19-22 ***American Cheese Society 9th Annual Conference.*** Madison, WI. Includes the ACS annual American specialty cheese tasting and competition. For more information call ACS at (212) 727-7939.

Sept. 21-25 ***Wisconsin Cheese Technology Short Course.*** Madison, WI. For information call Bill Wendorff at (608) 263-2015.

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Oct. 29-30 ***Wisconsin Cheese Grading Short Course,*** Madison, WI. For information call Bill Wendorff at (608) 263-2015.

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April 13-14 ***CDR Cheese Research and Technology Conference.*** Holiday Inn-West Towne, Madison, WI. Call Sarah Quinones at (608) 262-2217 for information.

CDR
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